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• *An analysis of the impact of technological development on corporate operations.*

Automation: The Management Approach

Malcolm P. Ferguson

BEFORE lining up my sights on as broad a subject as automation and how it should be evaluated by management, I would like to take a look for a minute at this amazing offspring of the combined sciences of mechanics, hydraulics, pneumatics, and electronics and try to put it into focus as a dynamic and changing force in our economy.

Automation has been hailed in some quarters as a "second industrial revolution." The same thing was said 30 years ago about the development of line methods of production . . . perhaps best typified by the mass production system that turned out the famous Model-T Ford so efficiently that the cars could be then priced as low as $290. If automation is indeed an industrial revolution, it is at least second, and probably the third, fourth, or even fifth such revolution.

The truth is that each generation is fascinated and impressed with the outstanding technological advances of its own time. This was true of the steam engine, the electric motor, the telegraph, the telephone, and the wireless. The automobile, the advent of powered flight and the harnessing of the electron as a practical tool were certainly revolutionary in their effect on our lives and our material economy.

About the Author—

Mr. Ferguson is President of Bendix Aviation Corporation. This paper was presented by him at the Twenty-Seventh Alumni Conference of this School, held in Ann Arbor on May 11.

More Goods With Less Effort

The whole history of technological advancement has had its real significance in the production of more and more goods and services by fewer and fewer people. Meantime, the technological progress produces new industries which create more and more jobs. Thus the curve of total production, as the index of the only real material wealth we have, keeps going right through the roof!

Referring back to the example of the introduction of line methods of production, I think we can see that it was at the time simply a new way for improving production, for making things faster and better at a price the public could afford. The step, therefore, was evolutionary rather than revolutionary.

The "lead time" before the original industrial revolution, when man developed the first practical machine power, was the accumulation of all previous history. Since then, the pace of technological improvement has constantly quickened . . . rising in a kind of geometric progression as each new advance provided more incentive, opportunity, knowledge, and even capital to explore still further the frontiers of science and technology. This exploration went forward, not only in industry, but in medicine, the arts, in fact in every field that has enriched our lives.

Automation is the latest and undoubtedly the most challenging example of this rising pace of advancement.

Revolutionary Effects of Technological Improvements

I have said earlier that technological improvements are evolutionary, not revolutionary. The revolution comes in their ultimate effect. The line production methods that Henry Ford applied to making automobiles (supposedly getting the idea from a visit to the Waltham Watch factory) produced a car that was so economical and practical it changed the face of America. Without detracting one bit from the contributions of other automotive pioneers, I think you can say that Henry Ford put the nation on wheels with his mass-produced "Tin Lizzie."

Now, aside from the massive automobile industry itself, the economic effects of all of this are staggering. When you think of the tremendous segment of the American economy that would not exist at all except for the fact that the whole country is on wheels, the very far-reaching effects of this technological change are obvious.

So in taking a look at automation, I think we are justified in defining it, in the broad sense, as the means to a new plateau of productivity and a new era of industrial progress. It is a way of doing things faster, better, and easier than we ever did them before and, in many cases, of accomplishing tasks that previously we couldn't do at all.

Modern communications, including television, is certainly a case in point. A prominent corporation in the electronics field reports, for instance, that about 80 per cent of its volume is in fields that either did not exist at all or were not commercially developed 10 years ago! When you see automation in this light, I think you will agree that it is not a bolt of lightning that will transform us in a flash but that it is part of a pattern of change whose probable ultimate effects stagger the imagination.

Interpretations of Automation

Let me give you three examples of different interpretations of automation that are current today.

To some writers, whose interest is concentrated mainly on the metal-fabricating industries, automation means simply the use of automatic transfer machines and equipment for moving work pieces from one machine tool to the next.

At the opposite extreme, some regard automation as a completely new approach not only to industrial processes but to problems of human organization in general. Finally, some popular writers use automation as a catchword which they apply indiscriminately to all forms of technological innovation.

While we have in "automation" a new word that is not yet used with very much consistency, the more serious students of the subject have managed to reduce it to cover about three different types of very "progressive" manufacturing:

The first is the installation of new and more complicated machine tools which perform as one operation processes that had previously been performed as a long series of separate operations by a long series of separate machine tools each individually operated.

Another type of innovation usually described as "automation" is the use of automatic "feed-back" devices, or "servomechanisms" that observe the work that a machine—or, indeed, a whole factory—is doing and act upon those observations in automatically adjusting the operation so it will not vary from pre-set specifications.

A third type of change often discussed under the heading of automation is the use of electronic devices in administration and engineering to record, store, process, summarize, and interpret information.

Automation, therefore, is not one thing but three or more separate things.

We have had automatic machinery replacing hand labor, increasingly, for centuries. Now we have automatic controls more and more replacing human controls in the supervision and direction of these automatic machines. This suggests another definition of automation. It's *"the automatic control of automatic machinery."*

Why Not "Electromation"?

Control systems that have a "sensing unit" for monitoring a process and an "activation unit" for controlling the process or making necessary corrections, are not new in principle. But developments in electronics, with a time response of a millionth of a second—including new components such as transistors and printed circuits—have greatly increased the dependability and versatility of these systems. It is already apparent that electronics will be one of the great factors in the future of automation—so much that we may see the use of a new word for automation—why not "electromation"?

Electronics is the science that deals with the electron, the smallest particle found in nature. About 30 thousand trillion trillion electrons (that's the figure 30 followed by 27 zeros) weigh less than an ounce. Electronic energy, as in a radio wave for example, moves at the speed of light. Because you can amplify, code, broadcast, compare, and do dozens of other things with electronic energy, you have a practical means of supplementing man's senses and brain power.

Electronics can hear, see, smell, touch and taste. Regarding the first two of these human senses, as we all know, electronic mechanism cannot only hear and see for us—as in radio and television—but can play it back so our own senses can have the sensation recreated. Of course, in the case of smelling and tasting we have not reached the point where electronics can play it back and reproduce a smell or taste for human enjoyment, but electronic machinery has been developed that can accurately and efficiently sense the things that are causing a smell or taste, and take action appropriate to the desired industrial process.

Electronics, which might be said to date, as a practical science, from Dr. Lee De Forest's invention of the vacuum tube in 1906, first revolutionized the communications industry. Then it was given a tremendous impetus by *aviation*, which today—for all practical purposes—would be absolutely grounded without electronic equipment. Here I am thinking not only of aircraft communications—instrument flight control, radar and some of the more dramatic electronic systems—but of other aviation uses of electronics that more nearly parallel the kind of things that go on when you begin to apply electronics to a factory or office.

The Synchro Principle

Let's take an example: The advent of multi-engine aircraft produced a very fundamental design problem. You've got four engines out there on the wings. In order to stay in the air very long, the pilot must know in his cockpit a lot of basic information about what's going on with those engines—such things as rpm, temperature, oil pressure, manifold pressure, fuel flow, propeller pitch, and so forth.

One way to relay this information to the cockpit would be to install a lot of cables, plumbing, and other gear just to operate indicators on the pilot's instrument panel. Since this was impractical, an answer to the problem was found via electronics. Let's take a sensing device on a particular engine . . . a valve that turns as oil flows to the engine . . . and connect it to a tiny, precision-built, non-rotating electric motor called an autosyn or synchro. The autosyn becomes an electrical position indicator and when it is connected by means of a fine wire to a similar unit in the cockpit, the second autosyn assumes the same position as the first. Then you amplify the faint electrical current that causes these two synchros to duplicate each other's position and you have enough energy to actuate an instrument panel indicator, which presents the oil pressure information visually to the pilot.

These versatile little devices, hooked in pairs, in series or in all kinds of combinations, are found by the hundreds in the modern high-performance airplane—350 in a modern bomber. They are used not only in the instrument systems but in all of the other automatic systems, such as the automatic pilot or flight control system, engine control, air conditioning and pressurizing and numerous others.

The synchro principle permits, further, an

electrical signal to tell some piece of power equipment to go into action to raise the landing gear, lower wing flaps, move the rudder controls. The power equipment, in this case, is called a servo-mechanism, a term associated with one broad area of automation.

Doing Jobs That Humans Can Not Do

Of course there are many automatic control systems in airplanes and in certain types of manufacturing today that are much more sophisticated than the process I have just described but I think you will see the point that in meeting the problems of aviation, know-how was evolved that now applies to many automation techniques and devices. For instance, a new jet airplane is so fast that you have to have a completely automatic system to measure, or meter, precise amounts of fuel and air to the engine or it will "flame out" or stall. So you have a system that electronically senses the speed of the inrushing air, its density, temperature, humidity and several other factors, and instantly computes and supplies the proper ratio of fuel required to make the engine operate at maximum efficiency. All of this is happening so fast that it would be impossible for the human pilot to "run it," even if he had nothing else to do. Here is one of those cases where electronics and hydraulics not only do a better job, but do a job that otherwise could not be accomplished at all.

Examples of Automation Machines

Time would not permit me to even start to describe the field of automation in machine tools, process machines, and in packaging, handling, and transfer equipment, but I will mention a few examples.

A pretzel-making machine pulls, forms, and twists the dough, bakes the pretzel, and packages them—50 per minute.

Perhaps one of your first views of automation was the cigarette-making machine in a New York window, but now its brother packages and cartons 150 packs per minute.

And there is a machine that fills, cleans, folds, closes, and packages tooth paste at 150 per minute.

One of automation's most interesting accomplishments is the automatic bowling pin setter—it uses a large number of automatic principles including conveyor, transfer, distribution, switching, and electric eye control.

I will mention just one of the thousands of industrial applications—the Chrysler Qualimatic engine plant—where the machines operate almost as one, and can turn out 3,000 engines in 24 hours. The plant covers an area of 600,000 square feet and cost approximately $50,000,000.

Tape Control

I would like to describe in a bit more detail one of the latest forms of machine automation utilizing what is called electronic numerical control, or tape control.

This new example of automation built by Bendix for Martin Aircraft under an Air Force contract is a 50-ton, three-axis milling machine with associated electronic equipment that virtually makes intricate parts from blueprints.

The tape-controlled process was first used in mass production by Bendix to solve a bottleneck in the manufacture of a small, intricate three-dimension cam that is one of the key parts of a jet engine fuel-metering system. In that instance, production of one "master cam" was a one-man job requiring from 10 to 14 weeks of highly skilled work. With the tape-control process, that operation can now be completed in from two to four days.

In the tape-controlled process, an engineer puts down on a process sheet the dimensions as determined from the blueprint. These figures are then typed on a special typewriter called a Flexowriter that produces at the same time a preliminary tape on which the blueprint information is punched in code and which can be readily checked. This preliminary tape is then fed through a special electronic computer to produce the actual control tape which represents the piece to be made. The finished control tape is then played back through the same computer and actuates the special controls on the milling machine or other types of machine to produce the piece itself—one or many.

The three-axis cutting motions of the machine are continuously monitored by "feedback" controls capable of detecting a motion of as little as two ten-thousandths of an inch. "Feedback," a word you will be hearing with increasing frequency, is part of a closed-loop system in an automated device that brings back information about the condition to be controlled for comparison with the target value.

Martin is going to use this newest example of heavy-industry automation in production of intricate large parts for the Matador tactical missile and the Seamaster four-jet seaplane. In the aviation industry, it will eliminate many weeks of tool-setup and tool-change time.

Tape-Controlled Machine Tools

Changing the "production run" on a tape-controlled machine tool is a relatively simple matter of changing the tape. Then, if you need to make an additional quantity of something you made last month or last year, the tape for it—which can be stored indefinitely—need only be pulled out of the file. If you want to change the design at some point, you can splice in a new section of tape covering the change. In the event of a national emergency, duplicate tapes can be made and sent all over the country to plants that have similar tape-controlled manufacturing processes.

To look beyond the defense industries, I think it is apparent that this process will have numerous other applications. In big manufacturing operations—such as an automobile plant—the tape-controlled process, or numerically controlled milling, could produce the dies for a major model changeover in about one-fourth the time now required. In small or medium-size industries, the tape-controlled machine tool offers the prospect that small lots of parts—say a few hundred or a few thousand—can be made economically because intricate and expensive tooling is no longer required.

Problems of Automation

These industrial applications point up some of the problems of automation.

In the first place, automation can occur only as fast as man can dream and devise the process and the machinery, and instrument industries can design and produce the necessary equipment. But while these industries may expand very rapidly, there are other factors affecting the change-over.

One of the most important of these is capital. Automation can occur only as fast as business firms can raise the capital needed to devise and build or purchase these fantastic developments of our inventive genius. Thus the health of our security markets, the increasing pressure of taxation, and the growth of our personal savings will all play a major part in such industrial progress.

The industries which have made the most progress toward continuous operation in the past are the very industries which have the largest investment per dollar's worth of net output per worker.

Leaders are petroleum and coal with $7.82 of assets per dollar of income and $105,000 of assets per employee, and tobacco manufacturing with $3.98 and $28,000, respectively. Near the bottom are apparel and finished fabric products with assets of 68 cents per dollar of income produced and assets per employee of only $2,160.

To many of you the further question is "Will it pay for itself?" I wish I might offer a ready formula for answering this knotty question. It is no different, however, from such problems of the past, but somehow the chips are bigger. We must also ask ourselves not just whether we can afford it, but can we afford not to do it in the face of today's severe competition. To assist in this evaluation many industries are establishing separate manufacturing development and application groups.

Another key consideration in progress toward automation is the tremendous demand it creates for skilled manpower. The new equipment cannot be designed or built until there are sufficient trained people to accomplish this first step—and no business is going to make an expensive change in equipment or methods without first making sure that the trained

manpower is available and their skills upgraded as required.

But automation may also require the training of more people in some of the traditional skilled manual occupations. In other words, automation may not only present a problem of new skills but also a quantitative increase in certain existing skills, such as those of machine tool manufacture and maintenance technicians for specialized equipment.

What People Think About It

However, of all the factors that will determine the speed and direction of automation, one of the most important is what people think about it.

"Wholehearted acceptance" of automation is most common among representatives of management. Many go so far as to say it is absolutely *essential* to attainment of national goals.

Ralph J. Cordiner, president of General Electric, testified at hearings held by the American Congress to explore automation and technological changes, that the United States will require an estimated 40 per cent more goods and services by 1965 though it will have only 14 per cent more people in the labor force. Industry must be encouraged, he said, to invest in more productive machinery and methods. Faster progress in the newer field of automation seems to us to be the only available solution to this problem, Mr. Cordiner said, particularly in situations where we have exhausted the known economic possibilities in the more familiar field of simple mechanization.

Telemetering

Let me give you another example of automated processes that will help to put this very broad subject into focus.

In the operation of guided missiles we have been using for some time a process known as telemetering. This involves the simultaneous coding, transmission, and recording of as many as 100 types of information about the behavior of a missile in flight, all in say two minutes. The information is received on the ground in the form of electrical impulses that can be logged on charts and then evaluated.

Now we have a commercial application of this same principle in a system that we call digital transmission equipment. It is a new system of measuring and monitoring at a distance that permits "push-button" operation of complex industrial processes going one or even one hundred miles away. It is applicable in almost any situation where it is desirable or geographically necessary to separate a human supervisor from the device or installation he is supervising. The system can operate over existing communications facilities, such as telephone and telegraph lines, and over very high frequency microwave radio bands. It operates on the "digital" computing system, measuring or sensing in terms of numbers, or coded "commands" are translated into action, such as the automatic positioning of shafts, off-or-on switching of motors, pumps and valves, or measurements of temperature, pressure, or other variables.

To illustrate how this system would work in a remote tank gauging system in the petroleum industry, an operator, connected by a single wire circuit to a tank farm, would "interrogate" a specific tank by dialing its number on his telephone dial. Instantly the level or volume reading of that tank appears in figures before the operator, and he then proceeds to interrogate any or all of the other tanks in the field.

This operation also permits continuous monitoring during the filling or pumping out of any tank, and adjustment of the liquid level to the desired depth through remote valve actuators.

Regulating Safety

The petroleum and chemical industries have many operations that are typical of the continuous-flow process which lends itself readily to automation, and these industries have pioneered in the use of many automated devices for control of pipelines, refinery pro-

cesses and the handling of chemicals where it is desirable to avoid coming into direct contact with them. Thus we see another important phase of automation in its safety possibilities. The original safety arm on a punch press has now progressed to cover remote control of enormous processes involving millions of dollars of equipment, and we not only detect and protect by electronic actuators but by eyes as well through industrial television. We must be prepared for safety regulators that may force such forms of automation.

And Now "Auto-Metrology"

In the factory, automation will affect not only direct machine operations but perhaps to an even greater extent such auxiliary operations as inspection or quality and assembly. Automatic measurement and the use of feedback for machine control are essential to an efficient automatic process—it's called "auto-metrology."

Auto-metrology deals with highly sensitive gauging and measurement systems that "think," record, and control part sizes through all stages of manufacture, assembly, and inspection. Automatic, split-second signals from the gauging and measuring instruments are flashed back to machine tools and machinery producing components. The signals sense and detect off-size dimensions as soon as they occur, or detect a trend and automatically place a "stop order" on the machinery to halt production until corrections to the proper size are made.

In the field of auto-metrology, we are frequently talking about very fine measurements or tolerances, even millionths of an inch. To give you an idea of how fine a measurement that is, the engineers point out that when a fly lands on a railroad track (just between the ties) the rail sags one-millionth of an inch.

Quality Improvement and Control

This business of precision measurement and the ability to make things, on a production-line basis, to finer and finer tolerances is very much a common denominator of technological progress. When James Watt devised his steam engine, we are told, he succeeded in fitting the pistons to a tolerance of "the thickness of a worn shilling," or about one-fortieth of an inch. Imagine the engine of your automobile if it were built to such crude tolerances! The automobile serves as a good example because when you think of the wonderful performance and reliability of today's cars as compared with those of, say, 35 years ago, you have to realize that the performance you have today would be impossible without very finely machined parts that fit together and run together with incredible smoothness. Achieving these fine tolerances requires such measurement devices as the air gauge, where you test the perfection of a part by a method that measures how much air under pressure can get past the part when you fit it into a space of the required dimensions. So we see another asset of automation—quality improvement and control.

The Computer

In discussing some of the more exciting developments in the field of automated manufacturing, I have not yet mentioned the computer as a tool in itself or the extension of automation to one of its most promising fields, which is the office.

Besides serving as part of a system for control, the computer in itself is having a profound effect on technology. Much has been written and said about the marvelous things computers can do and almost every day's newspaper carries a story or picture about some new electronic "brain" of awesome proportions and capabilities so I will devote limited discussion to this tremendous development.

But while these large million-dollar-and-up electronic computers are achieving fantastic results in the field of pure science and in certain special tasks in business and industry, it is the smaller or general-purpose computer that holds the most promise of becoming an everyday business and industrial tool. The general-purpose computer, which can be

priced below $75,000 or even made available on a rental basis, can, for example, enormously "lengthen the shadow" of the engineer by relieving him of time-consuming calculations. As an example, a leading highway engineering firm recently announced development of a system, using a general-purpose computer, that cuts highway survey and engineering time to one-thirtieth of what otherwise would be required—it calculates where a road should go for matching cut and fill. You can imagine the millions of dollars saved, plus the time of the engineers involved, in the application of such a computer to a major highway program.

In the office you may have a machine that will prepare the payroll, we'll say, in an hour. Many an office will have such machines. I might point out here that machine-made unemployment as a result of computer "brains" is a misconception. A survey shows that in 1940 we had in this country some five million people employed in clerical work. Today, the figure is 8 to 10 million. Clerical work amounted to 10 per cent of total employment in 1940 while today's clerical workers make up 15 per cent of the total working force. In fact, the long history of the arithmetic machine, from abacus to adding machine, cash register, calculator, and punched cards, shows that the faster the machine process, the more jobs the machines created for the men who work the machines.

Significance for Small Business

There is some concern that these great technological changes will be unfavorable for the continued growth of small business. History does not so indicate and I am not one that shares this concern. Such changes will not only create new jobs, but thousands of new businesses. The automation industry itself must produce devices both large and small. There will be small businesses in engineering, development, sales, servicing, and maintenance of product; and the inventive spark that has founded many new concerns will be even more prevalent. A visit to an automation show will demonstrate such trends.

Nor will the use of automation be the exclusive domain of the big corporations. It will be adopted, whether by large or small business, if—when all the eventual costs are totaled up—it is actually cheaper and/or better than continuing present methods.

Significance for the Economy and Management

I think it is clear that the ultimate significance of automation is that it is a way of increasing productivity—and hence our standard of living—to a degree which is almost impossible for us to imagine in the light of previous experience. Most assuredly, it is a new guarantee of the continual process of change that has marked all human progress. But the basic changes it will make will not come overnight, though the pace of change may certainly increase. The switch to automation will be a gradual process governed fundamentally by the marketplace or, in other words, by economic considerations.

When the internal combustion engine came to the farm, it replaced the horse only gradually. If, at the time, there had been a high tax on gasoline and a huge surplus of corn, we might yet be plowing with the horse. By the same token, automation will not come to industry just because of the marvels of engineering but only as it becomes economically feasible and desirable—or urgent, because of competition—to automate a given process. Management will, of course, have much to do with initiating automation but the old rules of practical business, including the need to earn a reasonable profit, must justify the change.

In this atmosphere of great potentials for advance, management will have to be more skillful than ever. *We will need more management* . . . tighter control and coordination of every detail of the production process . . . and probably more individuals at every level making more decisions of a management type than they had previously.

Management, for one thing, will have to approach automation with a basic *rethinking.*

What's "re-thinking"? Well, it's one of the new words popular in some areas of management, and it refers to the good old-fashioned practice of "taking a second look" (even after your mind's been made up) to see whether there isn't some way of doing a thing better. For instance, you have to ask yourself, What process lends itself to automation in a practical way?

One automation authority illustrated this point by citing the case of the Stock Exchange. Here, he said, was a process you could automate—not by giving the brokers on the floor of the exchange more gadgets—but by relieving them althogether of this phase of their work. The function of the brokers on the floor, he reasoned, was essentially to match up the offers to buy and the offers to sell shares. This, he said, was a job that could be readily handled by an electronic computer. The practicality of such a step would of course have to be decided by the exchange.

However, it's a fact that electronics is already doing some interesting jobs in the securities field. One of the largest brokerage houses recently installed a huge IBM "brain" to handle every account in the vast organization. An economics statistics service is using a computer to produce every hour on the hour a weighted average sale price for a group of 500 stocks. This process involves dividing every sale into the number of shares involved, then producing an average price based on shares traded.

Cooperation Between Managers and Engineers

A necessary part of this *rethinking* process will be a "drawing together" of the practical men in both business administration and engineering. In the more complex manufacturing industries, these engineers will be men whose fields require a tremendous understanding of many difficult sciences—some of them almost philosophical—in their application to a manufacturing business. They will be men who can master the newer dimensions of electronics, metallurgy, chemistry, physics, computation, and other forces that will be every-day tools in the manufacturing process.

This situation means that a tremendous effort has to be made to establish a new degree of understanding between departmental chiefs in an industrial enterprise. The business administrator will have to understand the jargon of the engineer, and the engineer must understand the basic essentials with which the administrator must deal.

Speedier Processing of Information

In looking at some of the horizons of automation, it is intriguing to note the economic effect that electronic equipment will undoubtedly have even if you think about it just from the standpoint of the speedier processing of information. Ups and downs in the business cycle are frequently due to incomplete information about the market, about the supply or inventory of goods, or, in other words, clues as to where and when to buy and sell. Now, the office whose function is to collect, evaluate, and act upon information can do all of this much faster and better—hence do a better job.

We have railroads using automation, not just in the operating sense, as in using radar and closed-circuit television equipment in classification yards, or mobile radio communications between trains, but to know almost instantly where a given carload of merchandise is and what to do with it. For instance, a carload of a certain grade of lumber might be shipped from Oregon before it is sold—the railroad car then becoming in effect, a "warehouse" on wheels. As this car moves across the country, it could be diverted or rerouted to the place where a customer needs it because electronic computers indicate at a central control point the location of every carload in the country of a particular grade of lumber. The Wabash railroad, for example, is now using a battery of IBM Transceivers to "punch out" the whereabouts, contents, and destination of a huge number of freight cars en route over the line. So in the faster transmission of information, as well as in manufacturing, auto-

mation provides a tremendous boost to our economic productivity.

Another interesting corollary of this boost in productivity will be a steadily expanding need for marketing services, such as advertising and all types of sales promotion. You don't need advertising where production is low and demand far outstrips supply. But in what might be termed an "economy of abundance" these services perform the essential function of preventing the market from being cluttered with unbought goods.

The Conditions of Progress

In conclusion, it is important to note that we now produce twice as much with each hour's labor as our fathers produced just prior to World War I, and four times as much as our grandfathers produced in the 1870's.

This remarkable achievement was neither accidental, nor the result of planned intervention by government.

Let us not forget in our concentration upon this topic of automation which emphasizes *things*—new and fascinating combinations of metal and wires and vacuum tubes and transistors—that all progress is of human origin. The driving force of ambition, the unpredictable course of man's inventiveness, and his knack of using his freedom of enterprise to build organizations that produce useful things and create income-producing jobs—these are the indispensable ingredients of progress.

So that much as I respect automation and its vast potentialities, I want to close by urging you to pay redoubled attention to the factors which either stimulate or imprison the dynamic capabilities of men and women. What they are inspired to do or prevented from doing will control what really happens to automation.

TABLE OF EXCUSES

Herbert P. Wagner, manager of the University of Michigan food service, has issued to his subordinates the following Table of Excuses:

To save time for management and yourself, please give your excuses by number. The list covers most situations.

1. **That's the way we've always done it.**
2. **I didn't know you were in a hurry for it.**
3. **That's not in my department.**
4. **No one told me to go ahead.**
5. **I'm waiting for an O.K.**
6. **How did I know this was different?**
7. **That's his job, not mine.**
8. **Wait till the boss comes back and ask him.**
9. **I forgot.**
10. **I didn't think it was very important.**
11. **I'm so busy I just can't get around to it.**
12. **I thought I told you.**
13. **I wasn't hired to do that.**

• *What are the advantages and disadvantages—to the investor—of convertible securities?*

Convertible Securities: An Investment Appraisal

Douglas A. Hayes

FINANCING via convertible securities has become increasingly popular with a number of leading companies. In recent years, for example, concerns that have issued convertibles include Sinclair Oil, Bethlehem Steel, Detroit Edison, Phillips Petroleum, Burroughs Corporation, Continental Can, and American Telephone and Telegraph. Indeed new issues of these securities among large publicly-owned firms may have amounted to almost as much as direct sales of new common stocks. Therefore, the magnitude of this type of security today justifies investors becoming acquainted with the factors pertinent to their appraisal.

These facts suggest many questions. One would be this: Why do these companies put out convertible securities to raise new money?

This question is not discussed in this article. For those interested in this phase of the subject, The School of Business Administration has published an excellent monograph: C. J. Pilcher, *Raising Capital with Convertible Securities,* Michigan Business Studies, Volume XII, No. 2.

Another question would be: Why do *investors* like convertible securities? This article is concerned with this question and related ones —the investors' viewpoint.

About the Author—
Dr. Hayes is Professor of Finance in this School; and teaches courses in Investment Analysis and in Commercial Banking. He has written articles for the financial journals, and a recent book, *Appraisal and Management of Securities* (New York: The Macmillan Company, 1956).

What is a Convertible Security?

The difference between a convertible and a straight bond or preferred is not complicated in principle, but it produces a major change in their characteristics for investment purposes to the great advantage of the investor. In brief, the convertible provision confers upon the holder of the senior security the right to exchange it for common stock on the basis of the specific terms indicated.

Theoretically at least, this provision removes the intrinsic disadvantage to investors associated with bonds and preferreds: their inability to profit to any significant extent by the growth of the company concerned because no matter how profitable the company becomes, the investor only receives the stated amount of dollar income indicated by the coupon rate on the security.

When the senior security is convertible, however, this reasoning no longer holds. If the company proves to be outstandingly successful as reflected by a material growth in earnings over a period of years, then the common stock should naturally increase in value. When and if this occurs, the holder of the convertible can either convert to common stock or sell his senior security which will always sell for at least the total value of the common stock that it can be exchanged for. For example, if a bond or preferred stock is convertible into two shares of common stock and this stock appreciates in the market from say $50 a share to

$75, then the senior security will necessarily show a commensurate increase in price from at least $100 to at least $150.

Therefore, in effect the investor in convertible senior securities always has the option to share in any significant growth of the company. On the other hand, if the company unexpectedly is confronted with an adverse period, some protection of income and principal relative to the common stock is obtained because of the senior claim on earnings and assets.

Careful Analysis is Helpful

But while a good general case along the above lines can be made for convertible securities as an investment medium, some sophistication in analyzing the specific terms and relative market positions is required to obtain these advantages in practice. Indeed because of the subtleties involved, it is quite possible for investors to make bad mistakes in connection with these securities.

The following comments are designed to assist the investor to appraise the relative attractiveness of the convertible feature as such. It is assumed that the other phases of an investment analysis, i.e., the appraisal of the economic stature of the company and its basic prospects and risks, have been satisfactorily handled.

The Convertible Feature as a "Sweetener"

One point, however, in this connection might be made. This is that investors are usually ill-advised to scale down conservative standards of quality for fixed-income securities in order to obtain the convertible feature. If this is done, the supposed defensive protection afforded by the senior claim can prove illusory.

Moreover, any significant evidence of corporate weakness makes all of the securities undesirable, and no combination of contractual privileges on a given security can offset this basic condition of good investment practice. In some instances it has been true that the convertible feature has been added to senior securities only because they were intrinsically weak in quality and, therefore, a contractual "sweetener" was needed to make the issue palatable to investors. In general we would categorically recommend avoidance of such situations.

It is assumed then that the prognosis for the company is favorable. In addition an analysis must show that the common stock at existing prices seems reasonably attractive on a long-term basis although it may, of course, be subject to considerable fluctuations in response to general market conditions. It is when these decisions have been reached that some consideration might well be given to a convertible security as providing an indirect position in the common stock as an alternative to its outright purchase.

The Key Measurements

To reach a conclusion on this point the following measurements must be made and then interpreted as to whether on balance they warrant one course of action or the other:

1. The indicated cost of the common stock through purchase of the convertible and ultimately converting it;
2. Comparison of this cost with the price of the common stock at that time;
3. The relative yields of the convertible and the common stock;
4. The yield of the convertible in relation to non-convertible senior securities of similar quality;
5. The amount of loss (if any) which would result if the senior security was called at the redemption price;
6. The duration of the conversion privilege.

Illustrative Examples

To demonstrate the use of these techniques in actual practice, the following data show the terms and prices as of April 15, 1957 for two relatively recent issues, the convertible 4⅜% debentures of Sinclair Oil and the $4.50 preferred stock of Continental Can:

	Sinclair Oil 4⅜ of 1986	Continental Can $4.50 Pfd. Stock
Price—convertible security	$113¼	$117
No. of common shares convertible into	1.54	2.4
Price—common stock	$63⅜	$44⅜
Current income yield—senior security	3.8%	3.9%
Dividend yield—common stock	4.7%	4.0%
Call price—senior security	$104⅜	$105
Duration of conversion privilege	Until Dec. 1, 1961[1]	Until Apr. 1, 1960
Approximate yields—good quality bonds	4.0%	——
Approximate yield—good quality preferreds	——	4.5

Cost of Converting

The first measurement suggested above requires only that the prevailing price of the convertible security be divided by the number of shares into which it is convertible. For the Sinclair Oil debenture this works out to $73.4 ($113¼ divided by 1.54) and for the Continental Can preferred it is about $48.7. In brief, by purchasing the convertibles at April 15, 1957 prices, the common stocks would cost these respective amounts per share if ultimate conversion took place.

The first disadvantage of obtaining an indirect position in the common stock via these convertibles rather than outright purchase now emerges. With the Sinclair Oil common selling at $63⅜ the investor must "give up" the first ten points ($73.4 minus $63.375) of any subsequent appreciation if the bond is bought now with ultimate conversion in mind. In percentage terms the first 13% appreciation on the common in the future will be lost. The terms in this respect were somewhat more attractive in the Continental Can situation as of that date. Here the investor was obliged to sacrifice about 4.4 points, or slightly less than 10%, of any future appreciation of the common stock. But all appreciation on the common stock in excess of 13 and 10 per cent respectively will automatically accrue to the convertible to an unlimited extent. Should the price of the Sinclair common go to $90 (say) then the bond would be "forced" up to $90 × 1.54 or $138.6 because that would be the value of the common stock embodied in one $100 bond.

[1] Conversion terms change on Dec. 1, 1961 reducing the number of shares into which bond is convertible. Thus existing terms terminate on that date.

Income and Safety

A second disadvantage of acquiring an indirect interest in a common stock with a convertible is that usually the existing income yield is somewhat less on the senior security. In the particular cases under review, the investor would obtain about 1% less current yield on the Sinclair bonds; in contrast only a negligible .1% sacrifice in yield was required to hold the Continental Can preferred instead of the common.

But in return for this yield sacrifice there is the fact that the relative safety of the income is considerably greater on senior convertible issues than on the related common stock. Common dividends, of course, can be reduced at any time, and could conceivably be eliminated altogether while the senior securities obtain their full contractual or preferred amounts. This feature would attract investors desiring greater reliability of current income, especially if there is some uncertainty about the outlook for general business conditions.

On the other hand while the convertible does not directly share in any increase in common dividends, it must be recognized that such a highly desirable development can be shared in via conversion at any time.

The "Price Protection" Feature

A more subtle defensive advantage accruing to an investment in convertible securities as compared with an outright position in the related common stocks is the "price protection" feature. This results from the fact that

convertibles have independent values as senior securities per se, exclusive of the conversion privilege. At any given time this basic value may be expressed as the price required to obtain the yield prevailing on similar quality issues without the conversion option.

The above table shows that these yields were about 4.0% on bonds similar to the Sinclair debentures and about 4.5% on preferreds comparable to Continental Can. The debentures, therefore, had an approximate price "floor" of about 106 where they would then yield 4% to maturity although the call price of only 104⅜ possibly might bring this price slightly lower.

Similarly the Continental Can would have a price "floor" of about 100 under the level of interest rates prevailing as of April 15, 1957. Potential price depreciation, in case of a sharp decline in common stock prices, but with no change in interest rates, would be about 6.2% on the debentures and about 14% on the preferred.

Sometimes over a period of time the common stock appreciates to a degree where the convertible security is "forced up" by the value of the common embodied in it to astronomical levels so that this protective feature no longer operates as a practical matter. A few years ago, for instance, the American Cyanamid 3½%, $100 par, Convertible Preferred had advanced in price to about $250 because it was convertible into 5 shares selling at $50 per share in the market. Here the price "floor" was around $100 or less than half the then prevailing price. In essence this preferred stock had all the price risk of the common while its yield was practically negligible. At such levels there seemed to be little justification for prudent investors to retain it, much less buy it.

Interest Rates and Price "Floors"

But this is still not the whole story on this point. If a decline in common stock prices was precipitated by a moderate deterioration in business activity, then it might be expected that the Federal Reserve authorities would follow a policy of monetary ease and as a consequence interest rates would decline. This action, of course, would raise the price "floors" on these securities to the level indicated by the new level of interest rates.

But even with a decline in interest rates, it is doubtful if convertible securities would sell for much more than their call prices when the conversion value is greatly reduced because of declining common stock prices. The call price represents the price at which the company, at any time upon about thirty days notice, can redeem the security. Unless there is a significant conversion value, the market is usually unwilling to value a senior security for much more than call price because of the redemption possibility.

Therefore, under the potential conditions of a stock market decline but rising bond prices due to lower interest rates generated by Federal Reserve action, the price "floors" on these securities might reasonably be measured as the call prices shown in the above table. Under these conditions the Sinclair debentures could well decline to about $105 or by 7% and the Continental Can to $105 or by about 12%.

Redemption Risk

Even at the level of common stock prices prevailing on April 15, 1957 there was some "redemption risk" associated with these securities. This is measured by the difference between the market price of the senior security and (1) the common stock value embodied in such senior issue or (2) the call price, whichever is lower.

As there was only $96.9 common stock value incorporated in the Sinclair bond ($1.54 \times 63\frac{3}{8}$) as of April 15, 1957, the investor was subject to a potential loss of the difference between the then existing price of $113¼ and the call price of $104⅜ in case of redemption.

There was a common stock value of about $106.4 embodied in the Continental Can preferred ($2.4 \times 44\frac{3}{8}$), so here the redemption risk was the difference between this amount and the price of $117. This of course assumes that in case of redemption the inves-

tor would convert and obtain stock worth $106.4 rather than surrender his security at the call price of $105.

Appraising the Redemption Risk

But for several reasons the investor might logically conclude that the risk of near-term redemption was not great. In the first place, the senior securities had only recently been sold (to the firm's own stockholders for the most part), and the funds presumably represented urgent capital needs. Idle cash to redeem these securities was not in prospect for either company.

Secondly—and perhaps more importantly—it seemed reasonable to presume that the reason convertibles were offered instead of other types of securities was to obtain common stock money ultimately via the conversion process when and if the common stocks appreciated in the future. Both had sufficient stature to market non-convertible debt or preferred stock. Therefore, redemption with a refunding non-convertible issue did not seem to be a reasonable expectation as of April, 1957.

However, if interest rates declined in the future for the reasons suggested above, the possibility of a refunding might seem greater, but again this would defeat the apparent purpose of obtaining common stock money ultimately through these securities. On balance it appears probable that the companies will not exercise their redemption option until and unless any one of the following circumstances occur: (1) interest rates fall to materially lower levels, (2) common stock prices rise and the assets obtained with the new capital are producing sufficient earnings so that "forcing" conversion via call will not dilute the earnings per share of the existing stock to any significant degree.

Duration of Conversion Privilege

The final factor pertinent to a decision on the attractiveness of a convertible relative to the related common stock is the duration of the conversion privilege. It is preferable, of course, to have the option remain constant for a number of years. By and large it is the possibility of realizing most of the long-term appreciation on the common stock and yet being somewhat protected against intermediate price and income declines that gives these securities their attractiveness to some investors.

In both of our examples this factor represents a moderate disadvantage to a potential investor. As we have already seen, the common stocks of Sinclair and Continental Can must appreciate by about 13% and 10% respectively before we would break-even on the conversion privilege at the relative prices prevailing on April 15. Therefore, some loss will be experienced unless at least this degree of appreciation takes place within the next 4½ years in the case of Sinclair and within 3 years in the case of Continental Can.

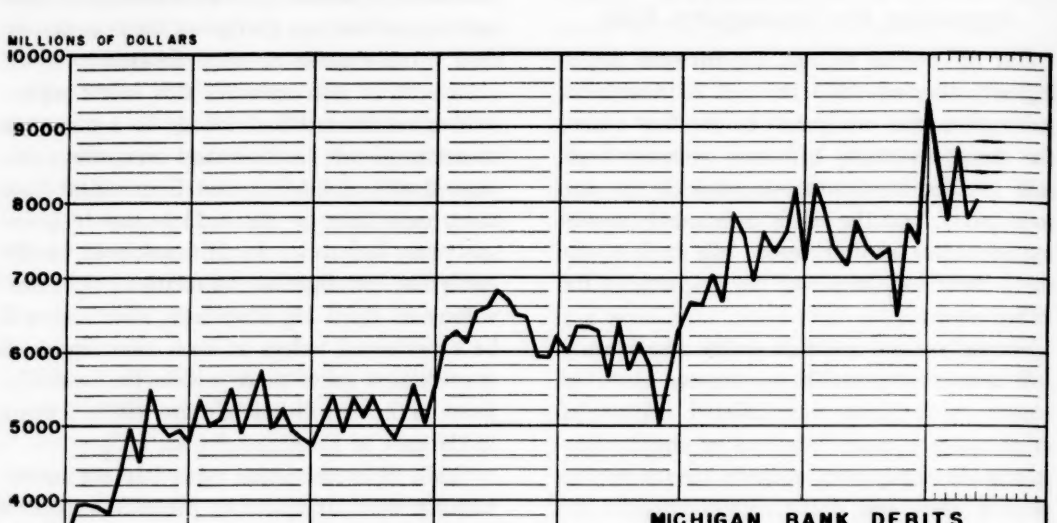
While this conversion period is not unreasonably short, it would be preferable to have somewhat more time to be absolutely sure that the long-term factors will be reflected in the prices of the common stocks.

Summary: Advantages and Disadvantages

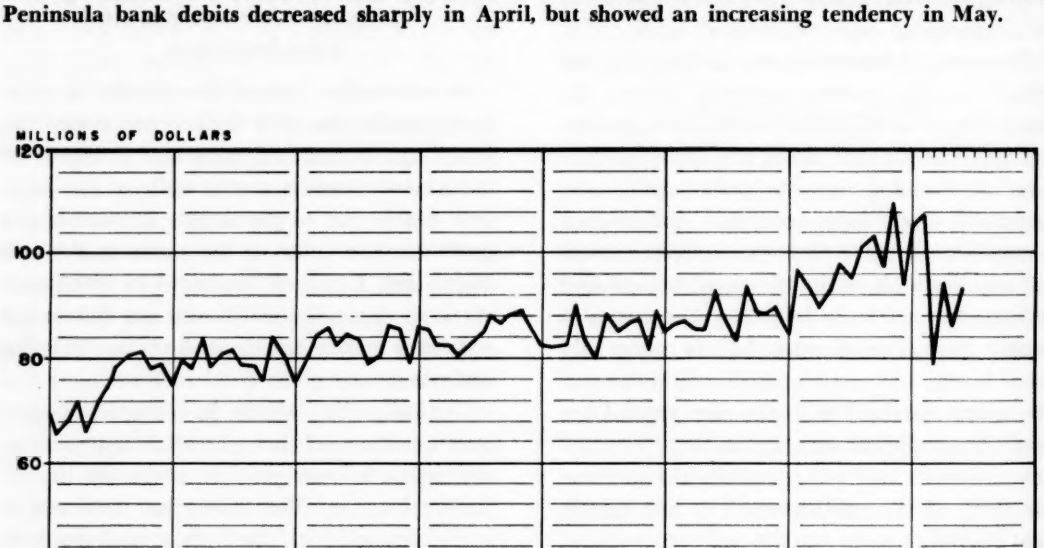
In summary, convertible bonds or preferred stocks may give the investor some "defense" against reduced prices and dividends on the related common stocks while at the same time enable him to participate in most of the growth in the value of the common stock in the market. However, the degree to which each of these desirable attributes are obtainable may vary widely and depend upon a detailed analysis at any given point in time.

Typically the investor in convertibles must sacrifice some of the potential appreciation and accept a lower yield in return for the defensive features. The techniques pertinent to a measurement of these factors have been briefly outlined above, and they may be of use to investors desiring a long-term equity position but at the same time desiring protection against intermediate market declines or dividend reductions because of temporary adversity either in the economy or in the particular industry.

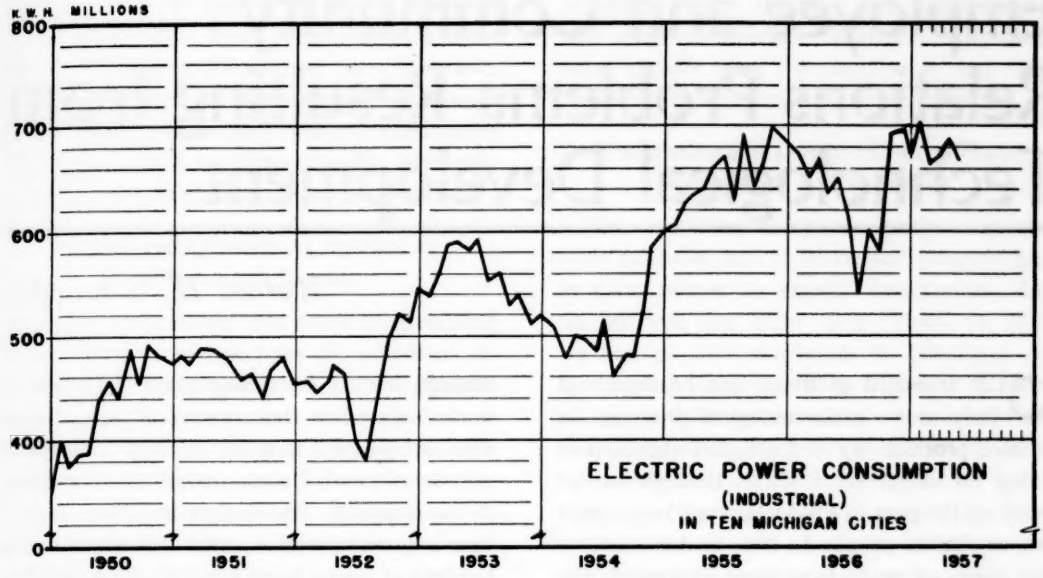
Michigan Business Indicators



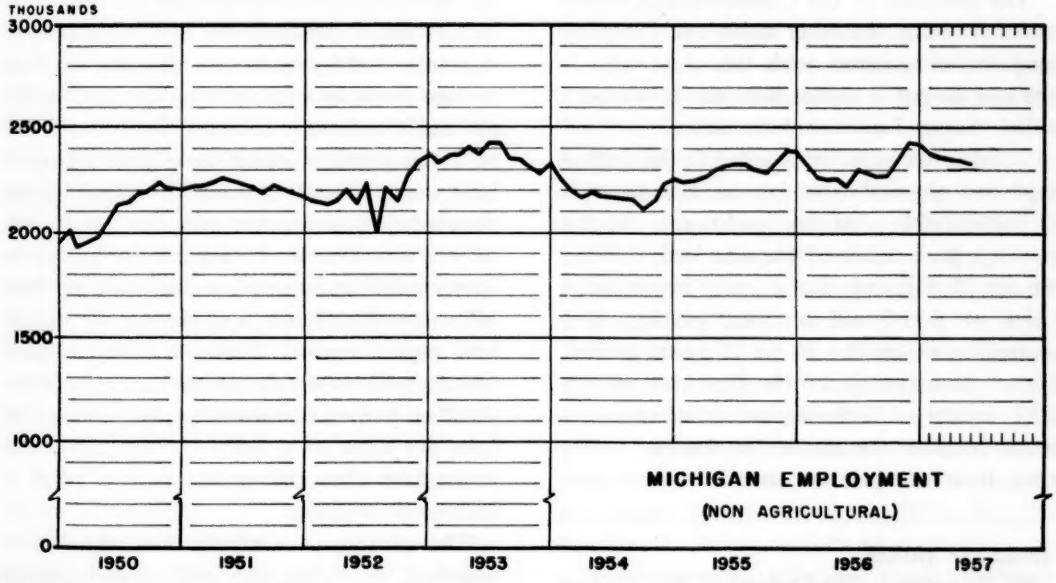
BANK DEBITS—THE MOST ALL INCLUSIVE MEASURE OF BUSINESS ACTIVITY—Lower Peninsula bank debits decreased sharply in April, but showed an increasing tendency in May.



UPPER PENINSULAR BANK DEBITS—Upper Peninsula bank debits showed a decrease in April from the rising March figure but rose again in May.



POWER CONSUMPTION—Industrial Power Consumption continued to rise in April and showed a slight decrease in May.



MICHIGAN EMPLOYMENT—Total employment continued to decrease slightly in both April and May.

• *A practical discussion of ways of dealing with*

Employee and Community Relations Problems Resulting from Technological Development

Harold H. Schroeder

OUR standard of living can be improved only as we make technical progress. In creased productivity and a higher standard of living no longer come about through harder work on the part of production workers, farmers, or clerical people. In fact, in our memory, the hours of work have been shortened, the heavy lifting has been reduced, and the pace of manual work has slowed down—but we have had increased productivity. It has come about through technological progress.

The president of the Comunications Workers of America, the labor union our Company bargains with, agrees with this view. This is the way he put it earlier this year in a speech titled "Labor Looks at Automation":

"Had it not been for progress in the field of replacing physical labor by machine labor, it is indisputable that we could not, in this country, have achieved the standard of living we are all enjoying. But equally important, I think we would still be doing grubby, dirty manual work on the 60 to 70 hours a week basis, characteristic of the first part of the 20th century. Technological advances have made possible the shorter workweek, leisure time, time for education, time for man to pass through life as something more than just a work horse. For that reason, it has always been our position that we welcome technological advance and, in fact, we will do everything to encourage it. The worker has more reason than anyone to rejoice as the machine lifts the burdens of heavy labor from his shoulders."

Mr. Bierne later points out that many people throughout the world are still working as primitively as our forefathers did and that the rich rewards of technological advances are still ahead for them. He goes on to say:

"Our job, it seems to me, is to maintain our vigorous, healthy economic situation so that we can move forward without fear and without strife to enrich as many lives as we can with the wonders which these new machines have made possible. Wherever possible, we should be discussing not only the broad overall but also the day-to-day, on-the-job problems created by automation and using our best efforts to solve them in a fundamentally decent and rapid manner. However, when talking about problems, we should not lose sight of the fact that automation doesn't only create problems but helps solve many of them also. Let's understand that automation is our friend if harnessed properly."

The greater productivity and the higher standard of living can and should benefit everyone. The general population benefits from better products and services at a lower

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cost. The workers benefit from higher real wages, shorter hours, better working conditions, greater security and safety. The companies that have refused to make technological improvements to match or exceed those of their competition have seen profits dwindle away. Some have disappeared from the scene.

Technological change suggests to some people that factories and even some industries of the future will run automatically, with only a few persons needed to control operations.

Improved Quality of Service or Product Is Result

I wish to emphasize that nothing resembling this result is in prospect for the telephone industry. We see changes ahead, but not changes of a revolutionary nature. Although we use large quantities of automatic equipment, the dial telephone being a good example, we are convinced that our business will continue to be operated by very large numbers of employees.

I hope you understand why I use the telephone industry as an example. It is the business that I know best. I started at the age of twelve helping my father with his telephone company that served a small farm community in Indiana. I saw the business before it had much technology—by today's standards.

As the telephone industry grew, it became evident that using operators for handling ordinary calls would be less and less suited to the large volume of calls that could be foreseen for the future. After a great deal of research, a dial system designed to meet our service requirements was introduced in 1920, permitting customer dialing of local telephone calls.

We have introduced dial equipment and many other scientific and technological improvements throughout the years for four basic reasons:

1. To improve the quality and usefulness of telephone service;

2. To satisfy the increasing demand for service;

3. To keep the cost of our product at a reasonable level, and

4. To enable us to pay the increasing wages needed to attract and keep an increasing number of good quality employees.

The result has been a marked expansion of telephone usage over the years. Telephones and telephone calls have increased many times more rapidly than the population, and more rapidly than the Gross National Product.

Technological Improvements Have Expanded Employment

The increased telephone usage resulting from scientific and technological progress has, in turn, helped to expand employment. Let me tell you that story very briefly. In 1920 we had no dial telephones in Michigan. At the present time, over 95 per cent of the telephones in Michigan are dial operated. About two-thirds of the long distance calls handled by operators are dialed direct to the called telephone. Customers now dial directly about a quarter of all calls outside local areas.

Yet, we have more than three times as many employees as in 1920, when there were no dial telephones. In 1920, there were about 8,000 employees; today more than 27,000. We have 7,400 operators in the state today compared with 4,500 in 1920.

The technological advances made possible a better service at lower costs and this in turn expanded the business and created more jobs. We are a regulated monopoly, but we are in competition for the customer's dollar. It was the improved service at reasonable cost that helped expand employment possibilities. The United States Department of Labor in its publication, "The Occupational Outlook" for February 1957 said it this way:

"For example, the dial telephone, far from slowing down the growth in number of telephone operators, stimulated the use of telephone services and increased the demand for telephone operators, so that their numbers rose faster between 1940 and 1950 than the number of clerical workers as a group."

A few examples will illustrate the improvements in quality. Dial switching now provides a faster and more uniform service. In the early

1920's, the average time required to complete a long distance call was about 10 minutes; now it's a little over a minute. Today more than 95 per cent of the long distance calls are handled while the customer remains on the telephone; in 1920, less than 10 per cent were handled this way.

Greater Variety of Services or Products

Technological progress has also increased the variety of the services we offer. As of today, there are more than 400 separate services available to our customers. Let me mention just a few by way of example: telephone service for ships and automobiles, service to foreign countries, teletypewriter exchange service, time and weather service, radio and television network service, and school-to-home services for convalescing children. Technological advance, therefore, not only gives the customer better service but a wider variety of services.

Costs To Customers Are Held Down

What has happened to the cost of this improving service? The Bureau of Labor Statistics started in 1935 to price the cost of local residence telephone service as a part of the so-called market basket of goods and services included in the Consumers Price Index. Since 1935, while the cost of *all* goods and services was going up 95 per cent, the cost of telephone service rose only 30 per cent.

The customers have increased their usage of the service tremendously. Technological progress and reasonable prices have stimulated demand—and this in turn has created more jobs. These new jobs generally require more skill—and are therefore higher paid—than before.

Shift from Low-Skilled to Higher-Skilled Jobs

The simpler accounting operations, such as sorting long distance tickets by the calling number, are disappearing, but more challenging jobs are created—working *with* the automatic machines. The operator who merely says, "Number, please," has been replaced by a machine, but the operator who says, "I'll be glad to try and reach him," is needed in augmented numbers.

In the 35 or 40 years that we have been replacing operators' work with dial equipment, we have developed a guide or pattern that is followed. At the heart of all the plans is the awareness that the Company has a social responsibility to eliminate or reduce the adverse effects on our employees.

Planning Is Necesasry

In establishing the date for an office to cut over to dial, the controlling consideration is to make that date sufficiently far in advance, generally about three years, to provide ample time for human as well as technical planning.

The cutover having been scheduled, an early step is to inform the employees and the union. The union is kept informed all the way through the program of the plans which affect employees. Usually, most of the employees on the payroll can be assured continued employment; this is partly because the force progressively reduces itself by resignations in the normal course, and partly because of the opportunities for reassignments.

During the preconversion period, all losses from the force are replaced, so far as possible, with people hired for temporary employment. These temporary employees are chiefly people who desire work for only limited periods, such as young women expecting to be married soon, former employees who are willing to return to telephone work to help out for a short period of time, or new employees who want a limited term job. We have found that there is a small but important part of the labor market—the woman who only wants to work for a few months.

Regular employees who had intended to resign or to take an early service pension prior to the cutover date are urged to defer this action, wherever possible, until the dial conversion. These steps are all designed to reduce the number of potential displacements. We

also plan in advance to provide transfer opportunities for employees. These transfers may be to other types of work or to other offices in the same or other communities. Necessary retraining is done at the expense of the Company.

As a result of these measures, few, if any, regular telephone operators are laid off because of dial cutovers. But to the individuals, however few in number, the layoff can cause hardship. For that reason, we have long standing severance pay plans under which employees who are laid off receive lump-sum payments varying in accordance with their length of service and wage rates. For the five most recent cutovers, the termination payments averaged over $600.00 to each employee laid off.

An observation was made some years ago about our treatment of employees in connection with dial cutovers. When she was Secretary of Labor, Frances Perkins wrote, "Of the hundreds of occupations in which women are listed in the Census of Occupations, only about a dozen employ more women than do the telephone companies. The human problem of the displaced worker when the cutover was made from the manual to the dial system telephone exchanges is an almost perfect example of technological change made with a minimum of disaster. It was accomplished through human as well as technical planning."

A Typical Case of Human Relations Planning

To see how it is done in a typical case—let's follow the story of Patricia Mason. Patricia was an operator in a medium-sized city that was slated for a cutover to dial. Two and a half years before the scheduled date, Patricia's chief operator talked with her about the possibilities. Yes, Patricia meant to keep on working—she was helping to support an invalid mother. No—she couldn't move to the large city where many jobs were available.

The chief operator mentioned the Commercial Service Representative job. She thought Patricia would be good at talking to customers about their service. The Commercial office were going to fill all their requirements in the next two and a half years from the operating force and temporary operators would be employed to take their place. Patricia didn't feel that she would like the Commercial job but did not turn it down completely. In the first interview no firm decision was reached, but the chief operator assured Patricia that together they would work out a good solution and that there was lots of time.

About a year before the cutover, the Plant Department could see the need for a replacement in a clerical job in a city 10 miles from the one being cut over to dial. In routine fashion, they told the operating department and when the chief operator asked Patricia about it, she was eager to try it. The job was just what she wanted—she had bought a car and liked to drive—the ten miles was no drawback in her opinion.

So, a few months before the cutover, and about a month before the woman who had the job was to retire, Patricia transferred to the Plant Department to learn the new job. Her place in the old office was filled by a temporary employee who only wanted to work a few months.

Multiply this by the thousands and you have a picture of the human side of our dial cutovers. Here are the actual figures for a recent cutover in a suburban office of Detroit:

There were 303 regular operators on the force before the cutover plus 171 temporary operators. Of the 303 regular operators, only 209 would be needed after the cutover. Of the 94 who were displaced, 79 transferred to other near-by offices, 13 were normal losses, such as marriage, pregnancy, and home duties; two requested a retirement pension and *none* were laid off. And some of the temporary operators, who were laid off, were re-hired a few few months later as normal losses reduced the force.

Large Amounts of Capital Are Required

We have talked about the effect of technological changes on our customers and our em-

ployees. Scientific and technological developments have created a continuing need for further capital investment in the business. The investment in our plant is now more than ten times what it was in 1920. Our investors have provided the capital for the machines that alone make it possible for more employees than ever before to each *earn* more than ever before. The capital investment per employee has doubled in 10 years, and is now about $26,000. This has made it possible to increase *real* wages.

Vital To Our Defense

In addition to the benefits brought to our customers, employees and investors, this progress in the technical field means a lot to the nation as a whole.

The fast, accurate and dependable telephone service now furnished in this country is vital to the common life of the nation and to the national defense. Further, developments in the telephone art have made important contributions to such projects as the DEW line, the air-warning system across the Arctic. Telephone techniques have also led to better military equipment such as the weapons systems used for the automatic aiming and firing of guns, the control of bombs, and the control of guided missiles such as the NIKE.

What Do We See in the Near Future?

I think the facts of the past provide the best clue to the future. Technological changes in our business will continue. They will make telephone service better, will widen its scope and will keep the price reasonable. Coupled with aggressive selling, which is a part of our program, such developments should further increase the usage of the service, and it is increase in usage that creates jobs. There will probably be some scattered adverse effects on a very few employees and these we will do our best to minimize. In the future, as in the past, there will probably also be fluctuations in employment. However, the long-term trend in our business has been one of increasing markets, increasing job opportunities and substantial capital investments. We see nothing in the present picture which should change this trend.

These technological changes which are ahead of us as well as those which have already occurred have their impact on employees, and on community relations. In addition to the actual disturbance that may be caused by a technological improvement there is often a resentment against the change just because it is a change. We all get to feel comfortable with things as they are. We get used to a certain arrangement of the furniture and we bark our shins on the coffee table when it is moved. We get accustomed to a certain way of doing things on the job and we resist a change, even for the better, at first.

How Can We Reduce Employee Resistance to Change?

Psychologists and sociologists are of some help to us with this problem. They have studied it in a variety of situations. They suggest the following factors as being important:

1. *Resistance to the change can be expected if the nature of the change is not made clear to the people who are going to be affected by it.* In other words, the change has to make sense to them. They may still wish that the change were not going to be made, but at least they will understand why it is being done, and that helps.

Management sometimes delays telling about a change because it will upset people, "let sleeping dogs lie." All too often, however, visits by the layout men, experiments by the methods people, rumors from the head office set off wild speculations that create much more havoc than the simple truth would—"the dog isn't really asleep." The grapevine is ever present and it can become pretty powerful. It grows best in the dark. Put some light on the subject and the grapevine withers and dies.

We try to tell the people who will be affected before we make a general public announcement. The technological change must have been definitely decided on. It would be folly to tell people about vague possibilities that

may or may not take place. However, once it has been definitely decided that something is to be done, the people are told about it.

Sometimes this can be done in a printed announcement if the change will not have much effect on people. Other times it is done in discussion meetings where there is a chance for two-way communication.

On major changes, like a cutover to dial operation, where the employees will have to learn a new method of operation and many will have to transfer to other departments and even to other locations—each person is interviewed individually. The first interview tells about the change and outlines the alternatives available. A later interview begins to make fairly definite plans regarding the change that will take place at the time of the cutover.

2. *Resistance may be expected if the change is announced as the whim or decision of the supervisor, rather than the necessary requirements of cost, efficiency, or quality.* Employees are more apt to accept and understand a change that seems necessary from the broader outlook. If the boss just states that *he* thinks it is necessary without giving the full story, it may be resented very much. On the other hand, the supervisor should make clear that he agrees with the change. The supervisor needs to understand the reasons behind the change well enough to feel that it is the best thing to do, so he can discuss it fully with his people.

3. *Above all, management must indicate that it is fully aware of the effect that the technological change will have on people.* If the change is planned and announced and carried out in such a way that it appears that management cares little or hasn't even considered the employees, there will naturally be strong resistance. The fact that management, at all levels, is sincerely interested in how the people feel and how it will affect their lives lessens the resistance to the change.

Management must sincerely have the interests of each person at heart and must show this interest in tangible ways. Retraining or added training should, where possible, be done on an individual basis. People must have time to adjust to the idea of change and to work out their own solution to the problems created by the change.

The feelings of the community toward technological change will be influenced by its over-all opinion of the Company. If the Company is seen as progressive and on its toes, a change that it makes would probably be seen as the proper thing to do—another indication of its alertness. If, however, a Company is viewed generally as being arrogant and ruthless, a change—even a good one—stands a good chance of being viewed critically.

The Public Must Be Informed

In our business, the major technological improvements, such as cutover from manual to dial service, make such a great improvement in the customers' service that the public is favorably inclined to the change. Even here, however, we find that it is important to let the community know about the plans that are being made to take care of the people involved. For several months prior to the changeover the manager will talk to civic groups about the plans for our employees. Advertisements and news releases will tell about the over-all planning. And, quite naturally, all telephone people will be talking to their friends and neighbors.

Perhaps the greatest effect on what the community thinks of the Company results from what our own employees say about us. If they feel that they were adequately informed, that they participated in the decision regarding their future, and that the Company had a real interest in their welfare, it is likely that the community will be favorably influenced.

We are becoming aware of another community problem. In the smaller exchanges that we have converted to dial operation, we may have removed all or nearly all the telephone people from the community. The whole working force has been replaced by machines. Interpreting the Company to the community and vice versa, by employees is made much

more difficult. We are trying a number of things that may help. For example, in some places, there are telephone people who live in the small community and work for us in a near-by city. Here, we are helping them to know more about the Company as it applies to the community where they live so that it will be easier for them to answer the questions of their friends and neighbors.

Where we don't have employees living in the community, we are planning to try the old "Town-hall" type of meeting from time to time where the townspeople gather to discuss a matter of importance to them—in this case, telephone service.

I've talked a lot about the business I know best, but I believe the same principles apply to other businesses.

Attitudes are formed by what you *do* more than by what you say or put into print. Good community relations in regard to technological development depends, therefore, upon the way companies act as they prepare for changes, put them into effect, and operate after they are in effect.

All along the line, however, from the universities, the schools, the press, the pulpit, from business, and from labor, the public needs to be better informed about the fundamental importance of technological changes in raising the standard of living of the whole community. More could be done than in the past to publicize the improved value in goods and services that have been the result of improved technology.

To Sum Up What We Have Talked About

If our experience is any guide:

1. There will be no *sudden* change in technological development. It will continue to be a *gradual* development.

2. Numbers of jobs will *increase*.

3. The major employment effect is a shift from relatively low-skilled to higher-skilled (and higher-paid) jobs.

4. Job content will change—but planning can minimize hardships—and planning is necessary.

5. It will require large amounts of capital. The investment per employee goes up—to pay for the machines—this makes the employee more productive—and makes it possible to increase his real wage.

6. Employees—and the public—must be kept adequately informed, to reduce resistance to these changes, which are for the long run good for us all.

OUR NEW SOCIETY

We have in the United States a workable society which is neither the creature of government nor a jungle of laissez faire. We have a society which with all its problems provides great material and spiritual blessings. What we have today is beyond socialism and capitalism. It is a new society. It is not perfect, nor is it materialistic and unjust. It is a society where ordinary men and women are getting ever a larger chance to use their initiative and imagination in satisfying work.

— John S. Coleman, President, Chamber of Commerce of the United States; President, Burroughs Corporation; in address before The Economic Club of Detroit, April 1, 1957.

• *Words are important;*
they may convey meaning or confusion.

Talking Ourselves into Communication Crises

William M. Sattler

UNSATISFACTORY communication easily leads to misunderstandings and strained relations among personnel in an organization. The vacuum created mitigates against group-belongingness, cooperation, and motivation. Moreover, many fancied notions rooted in the emotions of man are triggered into activity. We have, then, communication crises when we fail to communicate with others.

There are still other misunderstandings created by the evaluations and language choices of message senders. When our words do not correspond to life facts, when they are highly ego-centered, or when they strike a blow at the listener's need for self-respect, we open the way for our second class of man-made crises.

Points of View on Communication

The process of communication is more complicated than we customarily assume. In message sending we have (a) the speaker and his particular frame of reference, and (b) the listener who often has a markedly different perception of the situation referred to in the message.

These factors are recognized in this operational definition of communication expressed as a question: *Who says what—to whom—* and *to what effect?*

In an ideal situation we expect our listener to say, "I can *hear* you, I *understand* you, I *accept* what you say as correct and proper, and my *behavior* will be controlled by your message." If there is a breakdown at any of these four levels we commonly say that communication has failed. When this occurs we usually attempt to achieve better results by more communication—restatements, explanations, more reasoning, and verbal proofs.

A second point of view on communication failure should also be mentioned. "It assumes," says Fritz J. Roethlisberger, "that communication has failed when B (the receiver) does not feel free to express his feelings to A (the sender) because B fears they will not be accepted by A." This position makes communication a two-directional affair since participative action on the part of the listener is invited.

Basic Distortion: "Reports" Versus Reality

The fact that there are more than 600,000 words in the unabridged dictionary, plus perhaps 150,000 additional technical terms, suggests that we have a sufficient number of words with which to express our meanings. This however is deceiving—because the world of reality is ever-changing. With the exception of newly coined technical terms and occasional

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further additions, we are committed to a fairly stable vocabulary. We have what might be called a finite number of words to represent an infinity of external conditions.

In this sense man is blocked by the very nature of a vocabulary. What is more, words are a kind of shadow world since they are merely indicators, signs, or pointers. When the connection between words and events is not clear to either party to a conversation, shadow representation appears distorted to at least one person, and conflict is likely to ensue.

There are still greater problems facing us. Suppose a sales manager tells one of his salesmen, "I am shocked by what you have done, for you have broken a basic rule of our company by criticizing our competitor's product to a prospective buyer." On what basis did the manager arrive at this verbal output?

There is, first, the complaint registered by the buyer. This we can call the external situation. Next, the sensory end organs of the manager are affected by the light and sound waves emanating from the customer's oral complaint. How much or how little the manager hears and sees becomes a factor of importance when he listens to the customer.

And then come the intellectual interpretations made by the manager, the forces of emotion that affect his interpretations, and finally, the language choices he makes when he talks to his salesman.

What the manager says may or may not be an accurate depiction of the customer's statement, not to mention the possible distortion which the customer is capable of producing. The point is that the customer's statement, as well as the manager's verbalization, may be colored by *feelings*. When we talk we ostensibly talk about a situation, an occurrence, a person, but as humans we also talk about ourselves. For example, whether we call Executive X *firm, obstinate,* or *pigheaded* may depend more upon our feelings toward Executive X than on X himself.

Two types of input are thus operative when we verbalize: the situation external to the speaker and the speaker's special interests, feelings, and prejudices. In the form of an analogy, Francis Bacon spoke of Idols of the Tribe by saying, "The human understanding is like a false mirror, which, receiving rays irregularly, distorts and colors the nature of things by mingling its own nature with it."

Coupled with errors in observing and interpreting which Bacon considered as common to everyone, we must add also the so-called Idols of the Cave that encompass each person's private interests, education, and emotions. These give to the world of facts the stamp of the individual. Whether the weather is "hot" or "cold," the view "pretty," or John does "well" or "poorly" are conditioned by the observer's electrochemical bodily states.

In brief, then, we tend to project our feelings into what we say—"reports" and reality may therefore be out of alignment.

Language Habits That Create Communication Crises

The "reports" versus reality relationship will perhaps be most meaningful if specific language habits that cause communication crises are identified. The seven types of language barriers to understanding given here are a fair sample, but do not, of course, exhaust our faulty communication practices.

1. *Partial Representation.* On January 27, 1957 Secretary of the Treasury George M. Humphrey was asked to explain his views on the "depression that will curl your hair" theme. Reporters on the *Meet the Press* television program questioned the Secretary with a "You said *thus* and *so* on a given date." With excellent grace, and an apparent realization that communicators are easily misinterpreted, Secretary Humphrey at one point replied, "I am often surprised to learn what *'I believe'* when it is reported to me." What occurred, of course, was that news reports tended to minimize other aspects of the Secretary's statement. An abstracted version was offered with the implication that other explanations that might have been given were irrelevant.

The bold cover-page headlines in *Life* magazine on January 16, 1956 announced, "Three Times at Brink of War: How Dulles Gambled and Won." While this partial depiction was supplemented in great detail in the actual article, millions of Americans were nevertheless greatly alarmed. "Taken in the context of the whole article," wrote Editor-in-Chief Henry L. Luce two weeks later, in an effort to calm the storm of protests, "there is nothing in Secretary Dulles' words which is contrary to common sense . . . Nevertheless our use of these particular words in the headlines was unfortunate in that they did not fully reflect the main emphasis of the lengthy conversation which was the Administration's vigorous pursuit of peace." Partial representation, we see, can spell trouble.

Why is partial reporting plus inferential notions of completeness harmful in the business situation? Abstracting, to be sure, is important as a matter of economy, but if completeness is implied our listener can charge us with gross unfairness. The consequence: a breakdown at the *understanding, acceptance,* and *behavioral change* levels in communication.

Crises occur when the individual can legitimately say, "There are important matters which the boss didn't mention *and yet he implied completeness.*" Recall the occasions when we toss a written report aside with disdain because we are irked by the failure of the report to mention what we look upon as vital—or even to imply that there are other possible significant details.

We shall, of course, have to admit that what we say is necessarily an abstract of what might be said about a given matter. But we should be aware of this. We should likewise do our best in reporting the significant factors. This awareness plus an effort at itemizing factors should keep us from reporting "some" details in a manner suggesting completeness.

2. *Allness Words.* The executive is expected to communicate clearly as well as provide the proper stimuli to motivate others to high accomplishments. He must do so or, as Clarence B. Randall states, "stand aside and let his chair be occupied by someone who can." Yet when the executive uses the words "always," "everybody," and "everything" when life facts show *some,* or *20 per cent,* or *50 per cent,* he is clearly stretching the truth.

But there is also likely to be a "snapping back" to this stretching process. What occurs then is verbal argument in which listeners counter with opposing allness terms, unexpressed emotional antagonism, and possibly, let us hope, a return to reality—a return to the situation rather than the world of reckless symbolization. In the latter event the language used will center on specifics such as itemizing, quantification and qualification.

Executive John Jones was once told by his superior Mr. Black that he was "always bucking the decisions of the group." Jones, at least in his objective moments, knew that this was not an accurate statement and that Mr. Black should have said "twice in the past month." Following this language of allness the behavior of both executives solidified—each person carried in his head the idea of "I am always right." In this case there is clearly something more than allness involved, for we also have the questionable inference that opposition to decisions in the decision-making stage cannot possibly be "loyal opposition."

Time and perhaps soul-searching and prayer ultimately healed the breach between the two men. But the *allness* label and the apparent inability of Jones and Black to free themselves from this symbol, and therefore to see the facts before them, caused a needless misunderstanding.

Do speakers and listeners, as some of us might say, realize that sweeping generalizations are simply exaggerations? Do they have a private understanding to the effect that "always" really means "twice"? Sometimes this is true. Often enough, however, no such understanding exists and we thus create resistance on the part of receivers of messages by our false-to-fact language.

3. *Inferences and Value Judgments.* Presi-

dent Eisenhower in February 1956 presented what many Americans regarded as a frank appraisal of his state of health following his convalescence for coronary thrombosis. During the same month newspapers carried the reports of news commentators concerning the Eisenhower-Anthony Eden conference, and as one might expect, references to Eisenhower's health. The "reports" appeared on the same editorial page and on the same day. Commentator A said: "The President seemed to tire noticeably and was glad when the sessions were over." Commentator B perceived the situation in this fashion: "Eden . . . has never seen the President so vital, zestful, so stimulating in discussion." These of course are opinions or inferences that commentators are entitled to state, but they are not facts. It may be however that commentators A and B, and many readers as well, cannot tell the difference between inferences and facts.

Skill in inference-drawing is a significant attainment. Yet, remember, our inferences are ever subject to error, and our listener will bristle with animosity if we habitually make inferences without first giving detailed attention to facts. Inference-proneness is moreover like thinking in reverse, voting first and discussing later, or prescribing remedies prior to diagnosis.

When we make split-second inferences we are in effect engaging in gambling operations under unfavorable odds. What we say is verifiable if we find that John committed an error (*a fact*). Yet look at the possible inferences: (a) John didn't listen to instructions; (b) He needs training; (c) He is not interested, (d) He is not giving sufficient time to this phase of his work; (e) He is worried about items x, y, and z. If we confront John with one of these or possibly other inferences, we often find that we have jumped to a conclusion which John vigorously denies. We do not achieve a good working relationship by trying to convince John that our interpretative inference is right and that his is wrong. Soon, we find, that in our arguing about inferences we will unconsciously elevate probable inferences to the level of facts. From this there is likely to be no retreat—and no mutual understanding.

Pronouncing value judgments is a special type of inference-drawing which evaluative man tends to do in virtually all situations. Many times he does so quite properly. But judgment-making, when done unwisely or too frequently, introduces a barrier to acceptance, and likewise throttles creative thinking by subordinates. This is true because assessing goodness, correctness, or preferences by a superior settles the issue—a verdict has been given that is fair at least in the eyes of one person.

For example: Student A is not *lazy* simply because he asks to be excused from taking Course 300—two of his "required courses" may be scheduled at the same hour; Subordinate B is not necessarily a *dead-beat* merely because he failed to keep an appointment—he may have a legitimate reason; and Manager C is not *egotistical* if he fails on occasion to greet his employees— he could at these times be pondering helpful plans for employees. While it is probably true that we shall entertain such value judgments, depending upon our moods and inclinations, we will be better thinkers if we remind ourselves *to keep factually oriented*. We will moreover not become victimized by symbols that have a questionable validity except in so far as they conform to personalized feelings. And most important, we keep the road to productive communication open by exercising a reasonable delay in "jumping to conclusions."

4. *Two-Valued Words.* The engineer, scientist, or statistical worker plots degrees of difference which in some cases show hundreds of points on a continuum. In contrast to this practice, however, we find that many of us simplify differences by resorting to the use of antithetical extremes—good and bad, black and white, loyal and disloyal. These classifications—of doubtful validity in the first place —thereafter condition our thinking.

"Don't teach the fear of failure," said Charles F. Kettering, "how to escape respon-

sibility, or symbols instead of things." A symbol, as we have seen, does not have a necessary correspondence to the external world, as indeed it rarely does when we clumsily lump items into a twofold classification. Apart from the confused thinking that two-valued language suggests, listeners often object to our dual classification system when reality indicates that there should be three, or possibly even thirteen classifications.

One does not have to search far to discover how often we indulge in two-valued logic: (a) The Athenians divided humanity into two classes, the Athenians of course and the barbarians; (b) Aristotle remarked that whatever is done is done freely or under compulsion; (c) Lord Chesterfield said that the object of marriage is either love or money; and (d) Charles Lamb held that "the human species is composed of two distinct races, the men who borrow, and the men who lend." These classifications are interesting, possibly amusing, and also probably untrue. Smile if we will, but while we do so we might check our daily communications to see if we are also addicted to the two-valued disease.

When Secretary of Defense Charles E. Wilson in 1954 made the reference to *bird dogs* and *kennel-fed dogs* a verbal battle was quickly ignited. Apart from the effects of the analogy as word imagery, the classification is two-valued and as such implies that all workers fall into one class or the other. It is doubtful that many of us recall that his reference had to do with 110 men who were scheduled to be drafted from a specific district. With the reduction of the draft quotas following the Korean War, these young men would now be added to the labor force in what was a labor surplus area. Wilson believed that the 110 young men should be willing to travel as far as 100 miles for a job.

Secretary Wilson's intentions were of no avail as our news media poured forth charges that the Secretary showed callous indifference toward the unemployed. The two-valued labeling plus the emotional connotations of his labels kept misunderstandings, claims, and counter-claims in the limelight from early October until the November elections.

5. *Giving Words Static Meaning.* When we associate a rigid meaning to words we may delude ourselves into thinking that the world of fact is changeless. Many of us develop a stereotyped picture of management, labor, and department X, and consequently we are unable to keep up to date on changes. Soon our meanings for words become nothing more than emotional preferences which our listeners tend to reject.

The antidote, says the semanticist, is to use *index numbers* and *dates* to show differences and the passage of time. Rather than a false-to-fact picture of Sales Department, we should gear our meaning to Sales Department 1957 or projected Sales Department 1960.

Likewise the pictures inside our heads will be improved if we distinguish Salesman 1 and the situations he faces from those of Salesman 2. Such a pattern of thinking permits us to be accurate users of labels; and furthermore our dates and index numbers individualize communication in a way that listeners have a right to expect.

It is helpful to look upon others as persons who are capable of changing in personal outlooks, interests, and skills. We should reveal an awareness of these signs of personal development when we communicate with others. John 1957 is not the same person as John 1952—and he wants to be treated in a fashion consistent with the world of facts as per 1957.

What does *Republican* mean, or perhaps *New Republicanism,* or *Democratic*? Certainly meanings change. We cannot, for example, apply the 1900 stereotype of executive to a great many present-day executives.

A look at history: In Old English *soon* meant "at once," but now the word has a different meaning; *rash* meant quick or swift, and now means foolhardy; *silly* meant happy, *villain* a peasant subject to a lord, *marshall* a horse-servant; and *strike* meant "to stroke" or "rub gently."

6. *The One Word—One Meaning Fallacy.*

In addition to the changes in the world of facts which our words must keep pace with, we must also remember that words—except technical terms—have a variety of meanings. According to Charles C. Fries, the Oxford Dictionary records 14,070 separate meanings for the five hundred most-used words in English, or an average of 28 separate meanings per word!

We meet this problem in part by revealing our intent through the context of our statements. Yet many of our words such as "*edit* the report," "get the *survey* in," and "send an *introductory letter*" do not achieve clarity by context. We can achieve mutual understanding only by particularizing, or better still, by inviting the listener to feedback his interpretation of the message. "Explain some more," "Is this what you mean?" and "As I see it" may be helpful devices to use if mutual agreement is to overcome private notions of meaning.

The hazards of a routine one word—one meaning pattern of thinking was illustrated in the reports issued by commanders just prior to the World War II "Battle of the Bulge." Numbers of troops were classified under the categories of *assigned* personnel and *attached* personnel. What, in this case, does *attached* personnel mean? To the makers of the reports the label *attached* referred to "replacements in training or waiting to be assigned to combat units." Readers of the reports however conceived of *attached* units as personnel permanently assigned to battalions —a shocking difference in meaning!

After Charles F. Kettering perfected the self-starter an engineer at a meeting of the American Institute of Electrical Engineers said: "No wonder you made your self-starter work; you profaned every law of electrical engineering." Kettering protested by saying that he did not profane any fundamental laws of electrical engineering. "Those laws," said Kettering, "had nothing whatever to do with self-starters; they were written for something entirely different." We see, then, that for Kettering the words used to express the fundamentals of electrical engineering had a meaning different from that entertained by another reader of the laws.

7. *Insult Words.* The harmful consequences of "emotional erosion" as explained by F. F. Bradshaw in *Advanced Management*, November 1955, are in part caused by the insult labels we use. Often when we are thoughtless, frustrated, or incensed by others, and especially when we look upon others as pawns to be manipulated, we use words which stigmatize others. And to a greater or less degree we shall probably continue to do so, even though objective particularization is a better plan to follow if we seek to enrich human associations and the climate conducive to teamwork.

Insult words refer not only to name-calling techniques, but also to the attitudes of indifference, cynicism, and antagonism that we reveal when we engage in split-second contradictions. When we dismiss the views of others before we understand them, we show little respect toward these persons. In effect we say, "You're crazy—a fool;" and, in turn, our listeners react with, "You're another . . . ." Weeks later, perhaps, we confess that we didn't understand the speaker's meaning.

President Eisenhower reports that "hoots and jeers" greeted Admiral Mountbatten's 1942 suggestion that it might be necessary to construct artificial harbors and tow them to the coast of Normandy. "But two years later," as we now know, "it was to become a reality." The split-second contradiction reflected by scoffers would have doomed the proposal—open-mindedness and delayed judgment by some of our military leaders made it possible for the non-obvious solution to have a fair hearing.

"Semantic Noise" Applied to Speakers and Listeners

In the *Mathematical Theory of Communication*, by Claude E. Shannon and Warren Weaver, the engineering aspects of message sending are identified as "accuracy of transference of various types of signals from sender

to receiver." The word "noise" is introduced to explain unwanted additions, such as static and sound distortion, that make the received signal vary from the signal transmitted.

But in addition to "noise" in the mechanical sense, it is possible to speak of "semantic noise" when the sender chooses words that distort reality. What has been said concerning the seven language habits that create communication crises can be thought of as "semantic noise" produced by the message sender. And, likewise, when the receiver is motivated to distort the speaker's message, we may also speak of mental or "semantic noise."

The poet-philosopher Heine made this perceptive remark: "The arrow belongs not to the archer once it has left the bow; the word no longer belongs to the speaker when it has once passed his lips." We find that language affects thinking and behavior, and in some cases, the listener is fully victimized by word-magic. He is not likely to be able to say, "What does the speaker *really* mean?" nor "Let us figure out some new words to see whether we can agree." It takes uncommon good sense for the listener to translate the distortion created by the speaker into an objective depiction of what the speaker should have stated.

In still other cases when the listener has a predisposed attitude of opposition, he is deliberately seeking to discover distortions that may be committed by the speaker. While the message sender may protest and say that his words have been misinterpreted, the listener victimized by "semantic noise" tends merely to repeat back the damaging words originally uttered.

Korzybski, General Semantics, and Ourselves

In 1933, Alfred Korzybski used the term "general semantics" in his *Science and Sanity,* and tried to distinguish his view of semantics from the word studies of linguists, lexicographers, and logicians. "First order facts," he said, "are more important than definitions and verbiage." This point of view—perhaps obvious but neglected—suggests that Korzybski was interested in the study of language in a somewhat different way from most persons who analyze word meanings. His system is a living semantics that affects us in our daily communication in the community, in business, or in the home.

To be sure, occasional critics argue that there is nothing new in what Korzybski presents except the name "semantics," for roots of his ideas can at times be noted in dozens of sources ranging as far back in history as the dialogues of Plato. What he did however was to focus attention on language and communication by a detailed and systematic study that has in turn prompted others to explain semantics in books designed for the layman.

In large part the language habits explained in this article represent some of the theories and techniques given by Korzybski in his scheme for "retraining nervous systems" and thus improving human communication.

Semantics is sometimes as important to our behavior as the external conditions represented in our environment. On one occasion a section of employees were labeled "the dreamers" in a casual conversation. Presumably "thought" preceeded this label-giving, but the word itself wrought more havoc than one might expect because the men in this section thereafter were treated *as if they were* dreamers. And conflict was the consequence in a situation in which good human relations was a requisite for effective departmental performance.

Recall that the Nazis likened human society to the white ant colonies of Africa; and, having established this comparison, they treated human beings in this fashion. If we speak of other persons as lackeys who should be uncritical recipients of orders, we will tend to treat them with indifference and disrespect. If we refer to man as a machine, we may expect him to behave like a machine. Thinking, in short, does affect our language choices, but language also conditions our thinking and behavior.

Recommended Readings in Industrial Relations

Eleanor H. Scanlan

The Acton Society Trust. *Management succession.* London (39 Welbeck St.), 1956. 139p. $1.75.

The staff of the Acton Society Trust have reported on their research on executive selection, promotion and education in British companies with 10,000 or more employees. The title is very well chosen and a change from our own phrase—executive development. The sections largely follow the usual pattern of such books—background of managers, promotion from within, recruitment and talent spotting, management training. Section VII is entitled "How it Looks From Below" and reports on worker attitude in five factories. One appendix gives an edited record of a discussion group of nine senior officers regarding their companies' promotion policies and practices. American readers will have a minimum amount of difficulty with British phraseology.

The Acton Society Trust is a non-profit organization set up for the purpose of promoting economic, political and social research.

Andrews. Kenneth R. *Is management training effective?* HARVARD BUSINESS REVIEW (Soldiers Field, Boston, Mass.)

I. Evaluation by managers and instructors. Vol. 35, No. 1, January-February 1957. pp. 85–95.

II. Measurement, objectives and policy. Vol. 35, No. 2, March-April 1957. pp. 63–72.

The first of two articles by Professor Andrews reports Harvard's attempt to evaluate the effectiveness of educational programs for executives, which are conducted at Harvard and other universities. The research has been carried out among the participants in these programs, among the faculties on the various campuses and among the supervisors, colleagues and subordinates of the companies represented.

The participants are in agreement that high interest courses are those in human problems of administration, accounting and finance, and the economic and social environment in which business operates. They also place a high value on associations with other business men in the course and on release from day to day pressures. The qualifications, experience and behavior of the faculty looms as an important aspect also. Professor Andrews warns against selecting the noneducable man for participation in such programs and tells some ways in which he may be discovered in advance. He modestly offers three criteria for selection, based on the tentative findings. Some details are given regarding actual company reaction and experience at Humble Oil Refining Company, Westinghouse Electric Corporation and Aluminum Company of Canada, Ltd.

In the second article Professor Andrews discusses possible methods of measuring the results of management training programs. He gives in some detail the scope and objectives of the continuing education program which has been initiated by the American Telephone and Telegraph Company.

He believes that a company should look for no sudden change in men who return from these programs, but rather for evidence of self development and individual progress. In order to be effective, such university courses should be integrated with the training programs within the company. Making either type of training available to an executive should be regarded as one item in a continuous program of self development for him.

These special courses vary in content at the different universities, and a man should clearly understand why he has been selected to attend one rather than another. The choice should always be the particular course which will do the most to broaden his individual horizons. Also, lest he misunderstand the company's purpose in selecting him for such a course, Professor Andrews says, "The role that a given program is expected to play in a man's future should be

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All items mentioned are on file in the Reference Room of the Bureau of Industrial Relations and may be used by visitors there. Please write direct to the publisher for any items you would like to purchase.

made known to him, for considerable frustration is reported when those who return from the stimulation of the university program, expecting a promotion, find that the promotion does not come. If the company has hopes for a man which must be proved out, it ought to indicate this, along with the tentative range of possibility, to the man concerned."

Bradley, Philip D. *Involuntary participation in unionism.* Washington, D.C. American Enterprise Association, Inc. (1012—14th St., N.W.) 1956. 49p. $1.00.

This thoughtful paper discusses the "free rider" who, it is thought, receives union benefits without the obligations of union membership. The non-union man has been condemned by union leaders, by government boards, by the U.S. Department of Justice and the U.S. Supreme Court. Dr. Bradley says, "It is a curiosity of our Federal Labor Acts that under them the employer often emerges as the sole defender of the freedoms of individual workers." He raises the provocative question: Have unions created or obtained economic benefits? He points out the ambiguities and the lines of reasoning which must be considered before meaningful answers to the question can be provided.

Brown, Milon. *Effective supervision. N.Y.*, Macmillan Co., (60 Fifth Avenue, New York 11, N.Y.), 1956. 259p. $4.50.

"Effective Supervision" is an excellent book for men who are just entering the foremanship ranks and for those who wish to review the over-all aspects of their job. Mr. Brown has produced a very readable book which covers, in a logical frame-work, the many facets of the supervisor's job. Its second person wording gives the effect of being inside the foreman and viewing his responsibilities with his eyes. The opening chapters tell why the foreman was selected and outlines the broad area of his responsibility. The rest of the book is devoted to the day-to-day problems, such as induction, morale, cost control, union-management relations and training.

Bureau of Industrial Relations. University of Michigan. *A selected list of books and periodicals in the field of Personnel Administration and Labor-Management Relations, 1957 Revision.*

This selection of basic materials in the field of Industrial Relations is compiled by the Reference Librarian of the Bureau in cooperation with its teaching staff. Copies are available upon request.

Cordiner, Ralph J. *New frontiers for professional managers.* McGraw-Hill Book Co., Inc., (330 W. 42nd St., N.Y.), 1956. 121p. $2.75.

This publication reports the first series of lectures given at the Graduate School of Business at Columbia University, made possible by a grant from the McKinsey Foundation for Management Research, Inc., a foundation set up by the management consulting firm of McKinsey and Company. These three lectures by Ralph Cordiner describe the organization of the General Electric Co., its decentralization program, which was begun in 1951, and some guides for long-range planning. While it presents an over-all picture of the structure and philosophy of management of General Electric, it also serves as a pattern for modern American management.

Jessop, W. S. *Looking around: tapping new sources of knowledge.* HARVARD BUSINESS REVIEW, Vol. 35, No. 2, March-April 1957. pp. 147–157.

In line with Professor Andrews' thesis of a program of continued education during one's business life, the HARVARD BUSINESS REVIEW appropriately includes in the same issue an extensive reading list which the author recommends in order that we may keep up with modern thinking in Education, Physical and Social Sciences, and Human Institutions, such as Language, Economics, Philosophy and Political Theory.

Mr. Jessop comments, not on the reading list itself, but on the development of knowledge in the broad area which it covers, and on the need for greater understanding of this knowledge in modern business. No doubt the list will serve as a great stimulus to some, as a source of frustration to others, but in any case it will make a man hesitate before he sinks into a chair with a murder story or for an evening of television.

SUPERVISORY MANAGEMENT, published by the American Management Association ($6.50 per year) is now in its second year of publication.

Since its inception this magazine has been consistently interesting. About half of each issue is devoted to reprints and brief reviews of new literature and recent research findings. Original articles make up the rest of each issue (See "7 Myths about the Older Worker" mentioned in this listing). In addition to articles devoted to industrial relations subjects it features: Your Personal Management—*How to Read a Financial Statement* (Feb. 1957); *I'm not Working to Support the Landlord* (Jan. 1957). The style of this new journal is dignified without being stuffy. It does not talk down to its audience or rely on gimmicks in its presentation, although it usually contains a few well-chosen illustrations and cartoons.

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